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FEEDBACK AND ITS EFFECTIVENESS IN A COMPUTER-AIDED PERSONALIZED SYSTEM OF INSTRUCTION COURSE

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In a computer-managed version of Keller's personalized system of instruction, students received frequent feedback from more advanced students within the course. Overall accuracy of student-provided feedback was 87%, and students complied with 61% of the feedback.

DESCRIPTORS: instructional design, personalized system of instruction, online teaching, feedback

The personalized system of instruction (PSI) developed by Keller and his colleagues in the 1960s has been demonstrated to be more effective for university teaching than the more traditional approaches (Austin, 2000). At the University of Manitoba, a computer-aided personalized system of instruction (CAPSI) has been developed and field tested (Pear & Crone-Todd, 1999). A feature central to both CAPSI and PSI is the use of student assistants, called proctors, who score frequent short-essay tests and provide rapid personalized feedback to the test takers. Understanding how this feedback affects student behavior is prerequisite to addressing the practical issue of providing more effective feedback. The present study is the first to assess the effectiveness of feedback given in a CAPSI-taught course.

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METHOD

Participants and Database

The participants and database were described in detail by Martin, Pear, and Martin (2002). Briefly, the participants were 33 students who completed an undergraduate behavior modification course taught using CAPSI. The course was divided into 10 study units consisting of study questions from the course textbook; students wrote a test on each unit, plus a midterm and final exam. The CAPSI program assigned two proctors (students who had previously passed that unit) to mark each test and provide written feedback to the student taking the test. If there were not two students eligible and available to be proctors for a test, then either the instructor or the teaching assistant was assigned to mark that test.

Markers' primary responsibilities were to make a pass or restudy determination on a unit test and to identify, in a manner that was "nonpunitive and constructive," the deficiencies in an answer if it failed to demonstrate mastery (a marker was anyone whom the program selected to evaluate a test, including the instructor and teaching assistant; a proctor was a marker who was another student from within the course).

Unit tests were included in this study if they satisfied at least one of two criteria: (a)

The test contained a question for which the answer received detailed feedback (i.e., feedback other than a simple "correct" or "good answer") from at least one marker and the same question was asked again of that student on at least one subsequent occasion (i.e., on either a restudy test or on the midterm or final exam); (b) the test contained a question that had previously been presented to a student and the student had received an instance of feedback (IOF) on at least one of his or her answers to that question on an earlier test. The final sample for the current study consisted of 101 unit tests that contained one or more IOFs, 19% of the total 523 unit tests.

Procedure

Identifying and classifying IOFs. An IOF was a comment that suggested a way to improve the answer. Only question-specific IOFs were used (i.e., feedback that could only be used to guide changes in the student's answer to the particular question on which the feedback was given).

Each IOF was classified as one of five mutually exclusive types: model (the marker provided the correct answer or some part of it); suggestion (the marker provided a description of a change in the student's verbal behavior that would improve the answer); example (the marker gave one or more examples); question (the marker asked a question whose answer would improve the test writer's answer); page reference (the marker gave one or more page numbers indicating where material could be found in the textbook that would improve the answer).

IOF accuracy. Type A errors were defined as an IOF that was not based on an accurate reading of the answer, such as when a marker asserted that a student needed to add something to an answer that was already present. Type B errors were defined as an IOF that was not consistent with the information in the textbook.

Assessing compliance with IOFs. After all IOFs were identified, categorized, and assessed for accuracy, redundant IOFs (i.e., those that said the same thing for the same answer) were treated as single IOFs. Observers then made judgments as to whether or not students were compliant with IOFs. In other words, did the student improve his or her answer in a way that was consistent with the IOF? (More detailed descriptions of the methods for categorizing IOFs, assessing compliance with IOFs, and eliminating redundant IOFs are available from the first author.)

Interobserver agreement. Two people with expert knowledge of the course material practiced identifying comments as IOFs, categorizing IOFs, assessing IOF accuracy, and assessing compliance with each IOF until they achieved 80% agreement on all these tasks. A total of 21 unit tests were assessed for interobserver agreement. Agreements were 80% for identifying comments as being IOFs, 82% for determination of IOF type, 97% for assessment of IOF accuracy, and 90% for assessment of compliance with each IOF. In the case of disagreements on any of these four categories in the IOF assessment, the assessors discussed the disputed comment until they reached agreement.

RESULTS AND DISCUSSION

Feedback Type and Accuracy

Table 1 reports the relative frequency of the five types of IOF and summarizes IOF accuracy. Values reported are for nonredundant IOFs. Models and suggestions accounted for the majority of IOFs. IOF accuracy was 87% overall, and was slightly lower for models and for questions than for other types.

Compliance with Feedback

Compliance with nonredundant IOFs is summarized in Table 2. For 12 IOFs, com-

Table 1
IOF Accuracy as a Function of Type

Type	Total	% of Total IOFs	Accurate	% Accurate	Inaccurate	A	B
Model	78	46.7	66	84.6	12	8	4
Suggestion	73	43.7	66	90.4	7	7	0
Example	3	1.7	3	100	0	0	0
Question	10	6	8	80	2	2	0
Page reference	2	1.1	2	100	0	0	0
Suggestion/question	1	0.1	1	100	0	0	0
All	167		146	87.4	21	17	4

Note. "A" and "B" refer to Type A and B errors, respectively.

pliance was not applicable, either because the IOF was a Type A error or because the student's subsequent answer made the IOF irrelevant. All subsequent compliance statements refer to the remaining 155 IOFs. IOFs were complied with fully in 55% of instances. An additional 10 IOFs produced partial compliance, so that 61% of IOFs were complied with at least partially.

Some confidence that the degree of compliance was indeed a function of proctor feedback can be based on the extremely close correspondence (almost word for word) that occurred between models and the relevant portion of subsequent answers.

IOFs of Instructor and Teaching Assistant

Tables 1 and 2 summarize the IOFs provided by all markers in the course (the proctors, the instructor, and the teaching assistant [TA]). Together the instructor and the TA provided 31% of the IOFs in the sample. Feedback provided by these individuals was 91% accurate. Full compliance with nonredundant IOFs was 63% for the instructor and TA versus 50% for proctors only. However, the inclusion of IOFs that produced partial compliance greatly reduced this difference (63% for instructor or TA vs. 60% for proctors only). As was the case with the proctors, most of the IOFs of the instructor and TA were models and suggestions. The main difference was that the instructor and TA gave more questions than did the proctors.

Interestingly, there was some compliance with inaccurate IOFs. Of the 21 inaccurate IOFs (see the last row in Table 1), assessment of compliance was inapplicable for 8. Of the remaining 13, 9 were complied with at least partially.

The descriptive nature of these analyses limits the identification of variables related

Table 2
Compliance with IOFs as a Function of IOF Type

Type	Total	N/A	Full	% Full	Partial	None
Model	78	4	34	45.9	10	30
Suggestion	73	5	41	60.3	0	27
Example	3	0	2	66.7	0	1
Question	10	3	6	60	0	1
Page reference	2	0	1	50	0	1
Suggestion/question	1	0	1	100	0	0
All	167	12	85	54.8	10	60

Note. Values in the fifth column indicate percentage of IOFs that produced full compliance, after discounting any N/A (not applicable) IOFs.

functionally to feedback compliance. Future studies in this area should investigate the relation between feedback characteristics and compliance, and should attempt to determine ways to increase compliance. Unique contributions of the present study, in conjunction with Martin et al. (2002), are a reliable method for categorizing types of written feedback and the demonstration of measurable feedback accuracy and compliance with feedback in a CAPSI-taught course.

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